Amendments to the Claims

1–28. (Cancelled)

29. (New) A transmission system comprising:

an optical fiber;

a pair of transmitters configured to transmit respectively produced optical signals over the optical fiber, the optical signals being transmitted at the same wavelength and having orthogonal states of polarization;

a receiver configured to:

receive the respectively produced optical signals from the optical fiber;

filter two components of the received signal having the orthogonal states of polarization based on a transfer matrix $H(\omega)$ that is dynamically controlled responsive to two output signals to approximate a reverse transfer matrix of the optical fiber in a region of the spectrum occupied by the received signal to compensate for a polarization mode dispersion and a polarization rotation introduced by the optical fiber;

eliminate distortion and mutual interference effects for both the respectively produced optical signals; and

obtain an approximate repetition of the respectively produced optical signals at an output of the receiver.

30. (New) The system of claim 29 wherein the transfer matrix $H(\omega)$ is :

$$H(\omega) = e^{-j\frac{N}{2}\omega\tau} \begin{pmatrix} C(\omega) & D(\omega) \\ -D*(\omega) & C*(\omega) \end{pmatrix}$$

wherein the two functions $C(\omega)$ and $D(\omega)$ are given by:

$$C(\omega) = \sum_{k=0}^{N} c_k e^{-j(k-N/2)\omega\tau}$$

$$D(\omega) = \sum_{k=0}^{N} d_k e^{-j(k-N/2)\omega\tau}$$

with

$$|C(\omega)|^2 + |D(\omega)|^2 = 1$$

and where τ is an appropriate temporal delay, and c_k and d_k are complex coefficients that are dynamically controlled based on the two output signals.

31. (New) The system of claim 29 wherein the receiver comprises:

a polarization splitter disposed at an input of the receiver, the polarization splitter configured to divide the received signal into the two components based on their polarization; and

a demultiplexing device configured to filter the two components to approximate the reverse transfer matrix of the optical fiber.

32. (New) The system of claim 31 further comprising a photodetector configured to receive the two components from the demultiplexing device after filtering, and to output two corresponding signals to clock and data recovery circuits.

33. (New) The system of claim 31 wherein parameters of the demultiplexing device are dynamically controlled to minimize a predetermined cost function.

34. (New) The system of claim 33 wherein the predetermined cost function comprises a function of the sum of the mean square errors for the two output signals.

35. (New) The system of claim 33 wherein the predetermined cost function comprises a function of the sum of the openings of the rough diagrams for the two output signals.

36. (New) The system of claim 31 wherein the demultiplexing device comprises a planar lightguide circuit comprising a cascade of N identical elements, each element comprising:

an interferometrical structure having a delay τ between two optical paths;

a phase modulator controlled by a parameter Φ_n; and

a first variable coupler controlled by the parameter θ_n.

37. (New) The system of claim 36 wherein the demultiplexing device further comprises a second variable coupler θ_n disposed at an input of the demultiplexing device.

38. (New) The system of claim 36 wherein at least some of the N elements of the demultiplexing device comprises one or more additional phase modulators and one or more additional variable couplers.

39. (New) The system of claim 36 wherein each of the N elements of the demultiplexing device comprises one or more additional phase modulators and one or more additional variable couplers.

40. (New) The system of claim 37 wherein an overall transfer matrix of the device is:

$$H(\omega)=\left[\prod_{n=N}^{1}(H_{\theta_n}H_{\Phi_n}H_{\tau}(\omega))\right]H_{\theta_0}$$

41. (New) The system of claim 40 wherein the overall transfer matrix comprises a frequency dependent unitary transfer matrix defined by:

$$H(\omega)=e^{-j\frac{N}{2}\omega\tau}\begin{pmatrix} C(\omega) & D(\omega) \\ -D^*(\omega) & C^*(\omega) \end{pmatrix}$$

$$|C(\omega)|^2+|D(\omega)|^2=1$$

and wherein the two functions $C(\omega)$ and $D(\omega)$ are represented by their Fourier series expansion (N+1 terms):

$$C(\omega)=\sum_{k=0}^{N}c_k e^{-j(k-N/2)\omega\tau} \text{ and}$$

$$D(\omega)=\sum_{k=0}^{N}d_k e^{-j(k-N/2)\omega\tau}$$

where c_k and d_k are complex coefficients that are linked unlinearly to real control parameters of the demultiplexing device.

42. (New) The system of claim 31 wherein the demultiplexing device comprises a cascade of polarization controllers (PCs) and polarization maintaining fibers (PMFs).

43. (New) A receiver configured to receive a polarization multiplexed optical signal transmitted over a single fiber, the polarization multiplexed optical signal comprising two polarization multiplexed signals respectively produced by two transmitters, and to perform simultaneous compensation of polarization mode dispersion and demultiplexing of the polarization multiplexed signals, the receiver comprising:

a demultiplexeing device configured to:

filter two components of the polarization multiplexed optical signal having orthogonal polarization based on a transfer matrix $H(\omega)$ that is dynamically controlled responsive to two output signals to approximate a reverse transfer matrix of the optical fiber in a region of the spectrum occupied by the polarization multiplexed signals to compensate for a polarization mode dispersion and a polarization rotation introduced by the optical fiber;

eliminate effects of distortion and mutual interference for both the polarization multiplexed signals; and

obtain an approximate repetition of the two polarization multiplexed signals at an output of the receiver.

44. (New) The receiver of claim 43 wherein the transfer matrix $H(\omega)$ comprises:

$$H(\omega) = e^{-j\frac{N}{2}\omega\tau} \begin{pmatrix} C(\omega) & D(\omega) \\ -D^*(\omega) & C^*(\omega) \end{pmatrix}$$

and wherein the two functions $C(\omega)$ and $D(\omega)$ are represented by their Fourier series expansion (N+1 terms):

$$C(\omega) = \sum_{k=0}^{N} c_k e^{-j(k-N/2)\omega\tau} \text{ and}$$

$$D(\omega) = \sum_{k=0}^{N} d_k e^{-j(k-N/2)\omega\tau}$$

with

$$|C(\omega)|^2 + |D(\omega)|^2 = 1$$

where τ is a temporal delay, and c_k and d_k are the complex coefficients controlled dynamically on the basis of the two output signals.

45. (New) The receiver of claim 43 further comprising an input polarization splitter configured to divide the received signal into the two components based on the polarization.

46. (New) The receiver of claim 45 further comprising a photodetector configured to:

receive the two components from the demultiplexing device after filtering; and

send the two output signals to clock and data recovery circuits.

47. (New) The receiver of claim 45 wherein parameters for the demultiplexing device are dynamically controlled to minimize a predetermined cost function.

48. (New) The receiver of claim 47 wherein the predetermined cost function comprises a function of the sum of the mean square errors for the two output signals.

49. (New) The receiver of claim 47 wherein the predetermined cost function comprises a function of the sum of the openings of the rough diagrams for the two output signals.

50. (New) The receiver of claim 45 wherein the demultiplexing device comprises a planar lightguide circuit having a cascade of N identical elements, each element comprising:

an interferometrical structure having a delay τ between two optical paths;

a phase modulator controlled by a parameter Φ_n; and

a first variable coupler controlled by a parameter θ_n.

51. (New) The receiver of claim 50 further comprising a second variable coupler θ_n disposed at an input of the demultiplexing device.

52. (New) The receiver of claim 50 wherein at least some of the N elements of the demultiplexing device comprise one or more additional phase modulators and variable couplers.

53. (New) The receiver of claim 50 wherein all of the N elements of the demultiplexing device comprise one or more additional phase modulators and variable couplers.

54. (New) The receiver of claim 50 wherein an overall transfer matrix of the device is

$$H(\omega) = \left[\prod_{n=N}^{1} (H_{\theta_n} H_{\Phi_n} H_{\tau}(\omega)) \right] H_{\theta_0}$$

55. (New) The receiver of claim 54 wherein the overall transfer matrix comprises a frequency dependent unitary transfer matrix defined by:

$$H(\omega) = e^{-j\frac{N}{2}\omega\tau} \begin{pmatrix} C(\omega) & D(\omega) \\ -D^*(\omega) & C^*(\omega) \end{pmatrix}$$

$$|C(\omega)|^2 + |D(\omega)|^2 = 1$$

wherein the two functions $C(\omega)$ and $D(\omega)$ are represented by their Fourier series expansion(N+1 terms):

$$C(\omega) = \sum_{k=0}^{N} c_k e^{-j(k-N/2)\omega\tau} \text{ and}$$

$$D(\omega) = \sum_{k=0}^{N} d_k e^{-j(k-N/2)\omega\tau}$$

where c_k and d_k are complex coefficients that are linked unlinearly to real control parameters of the demultiplexing device.

56. (New) The receiver of claim 45 wherein the demultiplexing device comprises a cascade of polarization controllers (PCs) and polarization maintaining fibers (PMFs).

57. (New) A method of transmitting two optical signals over the same optical fiber at the same wavelength and with orthogonal polarization, wherein the two optical signals are respectively produced by two transmitters, the method comprising:

receiving the two optical signals over the optical fiber;

filtering two components of the received signal having the orthogonal states of polarization based on a transfer matrix *H(ω)* that is dynamically controlled responsive to two output signals to approximate a reverse transfer matrix of the optical fiber in a region of the spectrum occupied by the received signal to compensate for a polarization mode dispersion and a polarization rotation introduced by the optical fiber;

eliminating distortion and mutual interference effects for the two optical signals; and

transmitting an approximate repetition of the two optical signals obtained at an output of the receiver.

58. (New) The method of claim 57 wherein the transfer matrix *H(ω)* is:

$$H(\omega)=e^{-j\frac{N}{2}\omega\tau}\begin{pmatrix} C(\omega) & D(\omega) \\ -D^*(\omega) & C^*(\omega) \end{pmatrix}$$

wherein the two functions $C(\omega)$ and $D(\omega)$ are represented by their Fourier series expansion (N+1 terms):

$$C(\omega)=\sum_{k=0}^{N} c_k e^{-j(k-N/2)\omega\tau} \text{ and}$$

$$D(\omega)=\sum_{k=0}^{N} d_k e^{-j(k-N/2)\omega\tau}$$

with

$$|C(\omega)|^2+|D(\omega)|^2=1$$

where τ is an appropriate temporal delay, and c_k and d_k are complex coefficients that are dynamically controlled based on the output signals.